

TRANSLATION OF  
PCT ARTICLE 34 AMENDMENT

Trans. of PCT Art. 34 Amendment

O/P: NSC-M 838-UR

10/560989

4 IAPG Rec'd PCT/PTO 14 DEC 2009

The present invention is based on the above technological concept and the gist of the present invention is as follows:

(1) A high strength steel sheet excellent in formability, chemical converted coating treatment and hot-dip galvanizing, characterized in that: said steel sheet contains, in mass,

0.03 to 0.20% C,

0.005 to 0.3% Si,

1.0 to 3.1% Mn,

0.001 to 0.06% P,

0.001 to 0.01% S,

0.0005 to 0.01% N,

0.2 to 1.2% Al, and

not more than 0.5% Mo,

with the balance consisting of Fe and unavoidable impurities; the amounts of Si and Al in mass % and the target strength (TS) of said steel sheet satisfy the following expression (1); and the metallographic structure of said steel sheet contains ferrite and martensite;

$$(0.0012 \times [\text{target strength TS}] - 0.29 - [\text{Si}]) / 2.45$$

$$< \text{Al} < 1.5 - 3 \times [\text{Si}] \dots (1)$$

where, [target strength TS] is the designed strength of said steel sheet in terms of MPa and [Si] is the amount of Si in terms of mass %.

(2) A high strength steel sheet excellent in formability, chemical converted coating treatment and hot-dip galvanizing according to the item (1), characterized by further containing, in mass, one or more of 0.01 to 0.1% V, 0.01 to 0.1% Ti and 0.005 to 0.05% Nb.

(3) A high strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to the item (1) or (2),

EV 32024806945

- 4/1 -

characterized by: further containing 0.0005 to 0.002 mass  
% B; and satisfying the following expression (2),

$$500 \times [B] + [Mn] + 0.2[Al] < 2.9 \dots (2)$$

where, [B] is the amount of B, [Mn] that of Mn, and [Al] that of Al, each in terms of mass %.

5           (4) A high strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to any one of the items (1) to (3), characterized by further containing, in mass, one or both of 0.0005 to 0.005% Ca and 0.0005 to 0.005% REM.

10

          (5) A high strength steel sheet excellent in formability, chemical converted coating treatment and hot-dip galvanizing, characterized in that ferrite grains, wherein the ratio of the breadth to the length of  
15 each said ferrite grain is 0.2 or more, account for not less than 50% of the total ferrite grains in said high strength steel sheet according to any one of the items (1) to (4).

20

          (6) A high strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to any one of the items (1) to (5), characterized in that said steel sheet is a hot-rolled steel sheet or a cold-rolled steel sheet.

25

          (7) A high strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to any one of the items (1) to (6), characterized in that hot-dip galvanizing treatment is  
30 applied to said steel sheet.

          (8) A method for producing a high strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to any one of  
35 the items (1) to (7), characterized in that said steel sheet is produced through the processes of: hot rolling at a finishing temperature of the  $A_r3$  transformation

temperature or higher; coiling at 400°C to 550°C;  
successively applying ordinary pickling; thereafter  
primary cold rolling at a reduction ratio of 30 to 70%;  
then recrystallization annealing in a continuous  
5 annealing process; and successively skin-pass rolling.

(9) A method for producing a high strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to the item (8), characterized in that, in said annealing process, said steel sheet is: heated to a temperature in the range from the  $Ac_1$  transformation temperature to the  $Ac_3$  transformation temperature + 100°C; retained for 30 sec. to 30 min.; and thereafter cooled to a temperature range of 600°C or lower at a cooling rate of not less than X °C/sec., X satisfying the following expression (3),

$$X \geq (Ac_3 - 500)/10^a \dots (3)$$

$$a = 0.6[C] + 1.4[Mn] + 3.7[Mo] - 0.87,$$

where, X is a cooling rate in terms of °C/sec.,  $Ac_3$  is expressed in terms of °C, [C] is the amount of C, [Mn] that of Mn, and [Mo] that of Mo, each in terms of mass %.

#### Brief Description of the Drawings

Figure 1 is a graph showing the ranges of Al and Si for each target strength TS.

Figure 2 (a) is a graph showing the relationship between the performance of chemical conversion treatment and hot-dip galvanization and the amounts of Mn and B in the case of 0.4% Al, and Figure 2 (b) is a graph showing the relationship between the performance of chemical conversion treatment and hot-dip galvanization and the amounts of Mn and B in the case of 1.2% Al.

Figure 3 is a graph showing the relationship between the cooling rate for securing ductility and the chemical components.

#### Best Mode for Carrying out the Invention

The embodiments of the present invention will be hereunder explained in detail.

Firstly, the reasons for regulating the chemical components and the metallographic structure of a high strength steel sheet according to the present invention will be explained.

CLAIMS

1. (Amended) A high strength steel sheet  
excellent in formability, chemical converted coating  
treatment and hot-dip galvanizing, characterized in that:  
5 said steel sheet contains, in mass,  
0.03 to 0.20% C,  
0.005 to 0.3% Si,  
1.0 to 3.1% Mn,  
0.001 to 0.06% P,  
10 0.001 to 0.01% S,  
0.0005 to 0.01% N,  
0.2 to 1.2% Al, and  
not more than 0.5% Mo,

with the balance consisting of Fe and unavoidable  
15 impurities; the amounts of Si and Al in mass % and the  
target strength (TS) of said steel sheet satisfy the  
following expression (1); and the metallographic  
structure of said steel sheet contains ferrite and  
martensite;

20 
$$(0.0012 \times [\text{target strength TS}] - 0.29 - [\text{Si}]) / 2.45$$
$$< \text{Al} < 1.5 - 3 \times [\text{Si}] \dots (1)$$

where, [target strength TS] is the designed strength of  
said steel sheet in terms of MPa and [Si] is the amount  
of Si in terms of mass %.

25 2. (Amended) A high strength steel sheet  
excellent in formability, chemical converted treatment  
and hot-dip galvanizing according to claim 1,  
characterized by further containing, in mass, one or more  
of 0.01 to 0.1% V, 0.01 to 0.1% Ti and 0.005 to 0.05% Nb.

30 3. (Amended) A high strength steel sheet  
excellent in formability, chemical converted treatment  
and hot-dip galvanizing according to claim 1 or 2,  
characterized by: further containing 0.0005 to 0.002 mass  
% B; and satisfying the following expression (2),

35 
$$500 \times [\text{B}] + [\text{Mn}] + 0.2[\text{Al}] < 2.9 \dots (2)$$

where, [B] is the amount of B, [Mn] that of Mn, and [Al]

that of Al, each in terms of mass %.

4. (Amended) A high strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to any

one of claims 1 to 3, characterized by further containing, in mass, one or both of 0.0005 to 0.005% Ca and 0.0005 to 0.005% REM.

5. (Amended) A high strength steel sheet  
5 excellent in formability, chemical converted coating treatment and hot-dip galvanizing, characterized in that the ferrite grains, wherein the ratio of the breadth to the length of each ferrite grain is 0.2 or more, account for not less than 50% of the total ferrite grains in said  
10 high strength steel sheet according to any one of claims 1 to 4.

6. (Amended) A high strength steel sheet  
excellent in formability, chemical converted treatment and hot-dip galvanizing according to any one of claims 1  
15 to 5, characterized in that said steel sheet is a hot-rolled steel sheet or a cold-rolled steel sheet.

7. (Amended) A high strength steel sheet  
excellent in formability, chemical converted treatment and hot-dip galvanizing according to any one of claims 1  
20 to 6, characterized in that hot-dip galvanizing treatment is applied to said steel sheet.

8. (Amended) A method for producing a high  
strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to  
25 any one of claims 1 to 7, characterized in that said steel sheet is produced through the processes of: hot rolling at a finishing temperature of the  $A_r$ , transformation temperature or higher; coiling at 400°C to 550°C; successively applying ordinary pickling;  
30 thereafter primary cold rolling at a reduction ratio of 30 to 70%; then recrystallization annealing in a continuous annealing process; and successively skin-pass rolling.

9. (Amended) A method for producing a high  
35 strength steel sheet excellent in formability, chemical converted treatment and hot-dip galvanizing according to claim 8, characterized in that, in said annealing



5 process, said steel sheet is: heated to a temperature in the range from the  $Ac_1$  transformation temperature to the  $Ac_3$  transformation temperature +  $100^{\circ}\text{C}$ ; retained for 30 sec. to 30 min.; and thereafter cooled to a temperature range of  $600^{\circ}\text{C}$  or lower at a cooling rate of not less than  $X^{\circ}\text{C/sec.}$ ,  $X$  satisfying the following expression (3),

$$X \geq (Ac_3 - 500)/10^a \dots (3)$$

$$a = 0.6[C] + 1.4[Mn] + 3.7[Mo] - 0.87,$$

where, X is a cooling rate in terms of °C/sec.,  $Ac_3$  is expressed in terms of °C, [C] is the amount of C, [Mn] that of Mn, and [Mo] that of Mo, each in terms of mass %.

5

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☒ **FADED TEXT OR DRAWING**
- ☒ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☒ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☒ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**